

THE ECOLOGY OF AN ELFIN FOREST IN PUERTO RICO, 12.
A NEW SPECIES OF GONOCALYX (ERICACEAE).

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DURING THE COURSE of an ecological study of an elfin forest situated on Pico del Oeste, Sierra de Luquillo, Puerto Rico, a similar but not identical area, Cerro La Santa in the Bosque Estatal de Guavate-Carite, was visited and observed for comparative purposes.¹ The Cerro La Santa site is situated approximately 25 miles southwest of Pico del Oeste at a slightly lower altitude (903 m.) and has a lower annual rainfall. Surprisingly, the component genera of the two forests are very similar: some species are common to both, but in some genera different species are found. Two most interesting ericaceous plants belonging to the latter category are *Gonocalyx portoricensis* (Urb.) A. C. Smith from the Sierra de Luquillo and an undescribed species of the genus from Cerro La Santa. The purpose of this note is to describe the new species and to comment on certain aspects of the typification and date of publication of the genus.

With the addition of *Gonocalyx concolor* the genus comprises four species: one from Colombia (the type species); one from Dominica; and two from Puerto Rico. There are, in addition, two collections which may represent still other species belonging to this genus. In 1945, A. C. Smith annotated a specimen in the Gray Herbarium as follows, "Cuatrecasas 17184 represents an undescribed species, probably referable to *Gonocalyx*. Only one flower is available and the specimen does not seem ample enough for description." The specimen bears the following data, "Colombia, Departamento del Valle, Costa del Pacífico; río Cajambre; Barco, 5-80 met. alt. 21-30 abril 1944." The plant is an epiphytic shrub with carmine flowers and narrowly elliptic leaves. Smith may be correct in his placement of this entity but over-fractionation of genera in the Thibaudieae (or Vaccinioideae) makes intercalation of new material very difficult. Another collection, our specimen is sterile, which may belong to *Gonocalyx* is *Idrobo & Schultes 961*. "Colombia: Meta: Cordillera La Macarena (extremo nordeste) macizo Renjifo, cumbre y alrededores. alt. 1,300-1,900 m. Enero 6-20, 1951." The plant is epiphytic with a white corolla and leaves somewhat reminiscent in size and shape of those of *G. portoricensis*.

¹ The field work which led to this note was supported by a grant from the National Science Foundation (GB: 3975) to Dr. Richard A. Howard with whom I spent many instructive hours in the field. Special thanks are due Dr. Howard Pfeifer for locating and photographing certain critical specimens and notes while at Kew. Thanks are due Mr. R. Desmond, Librarian at Kew, for arranging the photocopying of critical text and to Dr. L. Emberger of Montpellier for the gift of a photograph of the type of *Gonocalyx pulcher*. The line illustration of the anthers is the work of Miss Pamela Bruns. I am also grateful to Mr. Joseph B. Martinson for providing facilities and generous hospitality in Puerto Rico.

Considerable emphasis has been placed upon the length of the corolla tube and the anther tubules in delimiting the genus *Gonocalyx* (see A. C. Smith, *The American Species of Thibaudieae*. Contrib. U. S. Natl. Herb. 28: 311–547. 1932, and H. Sleumer, *Vaccinioideen-Studien*. Bot. Jahrb. 71: 375–510. 1941). As a result of this approach, the genus may be composed of species which are not necessarily closely related (except for *G. portoricensis* and *G. concolor*). It is possible, if not probable, that the increase in length of corolla tube and anther tubules is the result of selection for specific pollinators and that this selection has occurred independently in Colombia, Dominica, and Puerto Rico. Each corolla segment is innervated by three main veins: a median and two laterals. The laterals depart from the main vein at the very base of the corolla tube. Further, the laterals do not fuse with those of the adjacent corolla lobes, a condition which I believe indicates “incomplete” fusion and one which may permit greater flexibility in modifying tube length. It does not appear that length of corolla tube and length of anther tubule are correlated i.e., the longer the tube the longer the tubules. On the contrary, it seems that in *Gonocalyx* the increase in length of corolla tube is a secondary and derived development and should not be considered of primary taxonomic importance in generic delimitation.

KEY TO THE SPECIES OF GONOCALYX

- A. Leaves elliptic, ovate, or orbicular, 0.5–3 cm. long, the apex obtuse, retuse, or acute and apiculate; flowers borne singly or in pairs in the leaf axils; anther tubules 8–11 mm. long.
 - B. Leaf margin entire or inconspicuously crenate; corolla tube 12–16 mm. long. Plants of Puerto Rico.
 - C. Leaf margin usually strongly revolute; calyx light green; corolla tubular, pink or rose fading to white at the apex, the corolla lobes erect; stigma at most subexserted at anthesis, white. *G. portoricensis*.
 - C. Leaf margin plane; calyx red; corolla campanulate, uniformly red, the corolla lobes spreading; stigma exserted at anthesis, red. *G. concolor*.
 - B. Leaf margin shallowly but conspicuously crenate at least towards the apex; corolla rose, fading to white at the apex, tube ca. 20 mm. long. Plants of Colombia. *G. pulcher*.
- A. Leaves ovate, 6–10 cm. long, the apex acuminate; inflorescence loosely racemose, axillary, 3–8-flowered; corolla red; anther tubules ca. 3.5 mm. long. Plants of Dominica. *G. smilacifolius*.

Gonocalyx concolor Nevl., sp. nov.

Frutex sempervirens epiphyticus parvus, irregulariter ramosus. Ramuli velutini rhodochroi. Folia petiolata ovata elliptica vel orbiculata 1.5–3 cm. longa 1.5–2.25 cm. lata \pm integerrima coriacea rigida plana apice acuta vel rotundata brevissime apiculata basi rotundata superficie glabra infra pilis sparsim instructa, nervo medio supra impresso, subtus prominenti. Inflorescentia lateralis uniflora. Calyx obprismaticus 3–3.5 mm.

longus ruber glaber. Corolla campanulata 13–15 mm. longa 6–7 mm. in diametro ruberis lobis patentibus 2–3 mm. longis 4 mm. latis. Stamina 10 aequilonga exserta antheris ca. 3 mm. longis apiculatis tubulis ca. 10–11 mm. longis, filamentis liguliformibus ca. 2 mm. longis. Ovarium 5-loculare, ovulis pluribus. Stylus filiformis ruber; stigma minutum. Baccae non visae.

Holotypus: *Howard & Nevling 16947* (A).

Small epiphytic shrubs, evergreen, the young branches and leaves rose-colored, minutely velutinous and glabrescent. Leaves simple, alternate, coriaceous, the blade ovate, broadly elliptic, or nearly orbicular, 1.5–3 cm. long, 1.5–2.25 cm. broad, apiculate and obtuse to acute at the apex, rounded at the base, glabrous above, with a few large trichomes beneath, the venation 5-ple from the base, outer set marginal, inner set submarginal and better developed, the midvein immersed above, emergent beneath, the margin entire except for a few inconspicuous crenations toward the apex; petiole to 2.5 mm. long, velutinous, young leaves brilliantly rose-colored becoming green. Flowers bisexual, 5-merous, regular, uniformly vivid red (Nickerson 5R 5/13), borne singly on axillary brachyblasts, semipendent; pedicel terete, 9–11 mm. long, red, fringed with trichomes at the summit, bibracteolate near the base, articulated with the calyx; calyx tube obprismatic, 3–3.5 mm. long, conspicuously 5-ribbed, ribs alternisepalous, red, glabrous, the lobes very broad and apiculate, the calyx limb margin nearly entire; corolla tube campanulate, 13–15 mm. long, 6–7 mm. in diameter, carinose, with a few multicellular trichomes mostly below the middle, glabrous within, deciduous, the lobes 5, 2–3 mm. long, 4 mm. broad, spreading; stamens 10, equal, free, inserted on a fleshy 10-lobed disc, deciduous, the anther sacs granular, ca. 3 mm. long, apiculately appendaged, pollen in tetrads, the tubules ca. 10–11 mm. long, opening by introrse elliptical pores 0.5–0.75 mm. long, apices exserted, the filaments liguliform, pubescent on margins, ca. 2 mm. long; ovary inferior, 5-carpellate and -loculate, the placentation axile, ovules many, the style filiform, vivid red, glabrous, persistent, the stigma truncate, exserted at anthesis. Berry not seen.

Specimens examined: **Puerto Rico.** Bosque Estatal de Guavate-Carite, Cerro La Santa, *Howard & Nevling 16947* (A, holotype; isotypes to be distributed), *Howard 17255* (A), *Wagner & Wagner*, April 27, 1968 (A), *Bro. Alain Liogier 10405* (GH, NY).

There is little question that *Gonocalyx portoricensis* and *G. concolor* are derived from common ancestral stock. There is great similarity in many details and in aspect, as well as geographic proximity. The differences which have developed are due, in my opinion, to a divergence in the pollinators. The flower of *G. portoricensis* is pendent with a light green calyx and a corolla tube which is pink or rose at the base fading to white at the orifice. The filaments have inwardly and laterally directed trichomes protecting a green, glandular base. It is most likely that it

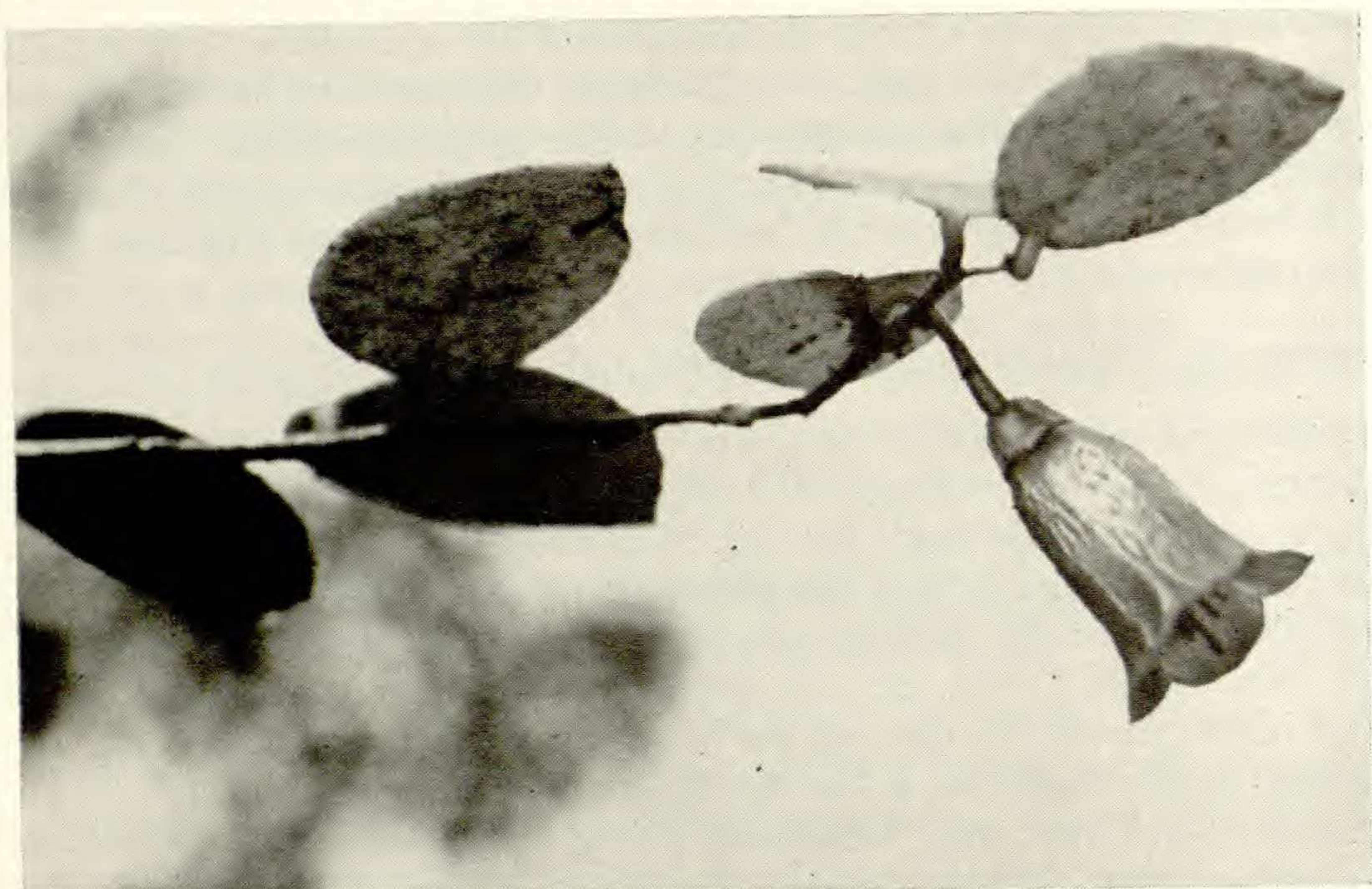


FIGURE 1. Photograph of *Gonocalyx concolor* (Howard & Nevling 16947) in nature, approximately twice natural size.

is insect pollinated although it must be pointed out that this species was under observation on Pico del Oeste for a period of two years and no pollinators were observed. It is in flower sporadically throughout the year and seems to set fruit regularly. The flower buds are sometimes parasitized by an unidentified insect larva which eats the anther sacs and pollen. The newly described *G. concolor* differs, in part, by having the flowers semipendent (borne at about 45° from the vertical), with vivid red calyx, corolla, and stigma. In addition, the corolla tube is campanulate with the lobes spreading (see FIGURE 1). Slight differences are also noted in the details of the anthers (FIGURE 2). It is possible and purely speculative, for no pollinator has been observed here either, that this species has diverged towards hummingbird pollination. It has been collected in flower in December, January, February, and April and doubtless has a much longer flowering period.

A problem which came to my attention during the preparation of this note was an apparent discrepancy in the date of publication of *Gonocalyx pulcher*. There are several publications of 1856 which must be considered in some detail to resolve the matter. These are presented in presumed chronological order for discussion.

1. GARDENERS' CHRONICLE 1856: 152. (March 8) 1856.

Under the title "New Plants" is listed "164. GONOCALYX PULCHER Planchon and Linden Fl. Columb. ined. We have received from Mr. Linden a coloured representation of this pretty plant which he offers for sale at 25 fr., and of which we translate his description." The descrip-

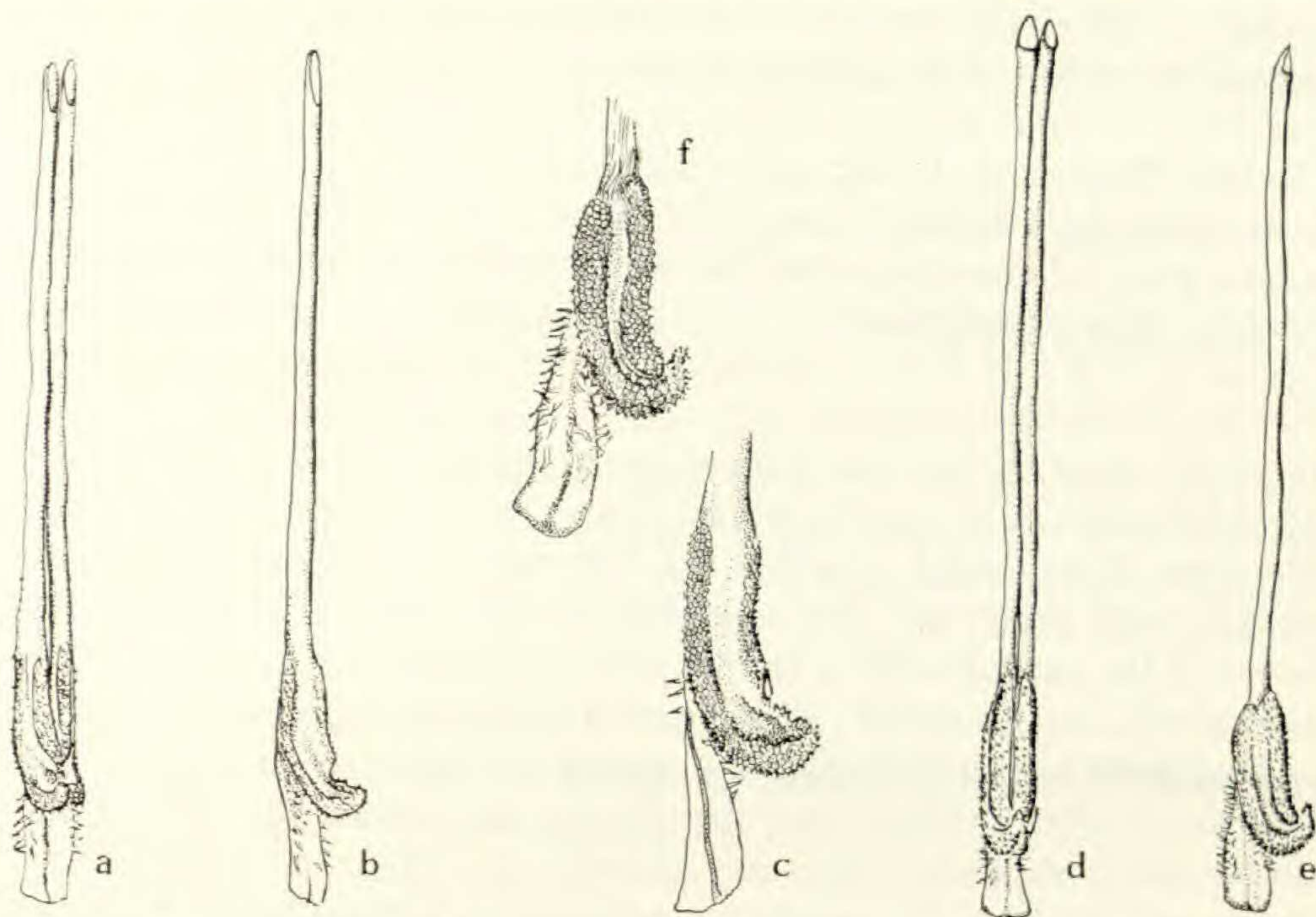


FIGURE 2. Stamens of *Gonocalyx portoricensis* and *G. concolor*. a-c, *G. portoricensis*; a, stamen, adaxial view, $\times 4$; b, stamen, lateral view with only one tubule shown, $\times 4$; c, filament and anther sac, lateral view, $\times 6$; d-f, *G. concolor*; d, stamen, adaxial view, $\times 4$; e, stamen, lateral view with only one tubule shown, $\times 4$; f, filament and anther sac, lateral view, $\times 6$.

tion follows and is accompanied by a black and white illustration of a single flowering branchlet.

This publication is cited in *Index Kewensis* (Vol. 2) as the place of publication of *Gonocalyx*, an opinion which was accepted by two specialists in American Ericaceae, A. C. Smith and H. Sleumer. The *Index Nominum Genericorum* lists the generic authority as Planchon et Linden ex Lindley, while Supplement 13 of *Index Kewensis* has an entry attributing the genus to Planchon & Linden ex A. C. Smith!

2. FLORICULTURAL CABINET 24: 57. (March) 1856.

Two plants, *Cuphea eminens* and *Gonocalyx pulcher*, are described in English, each in a separate paragraph. Each description is chatty in nature and presents some of the information included in *Gardeners' Chronicle* plus a few notes on horticulture. Some errors have been introduced including the notation that the *Gonocalyx* is from Ocana, Mexico. A colored plate illustrates a flowering branch of each species.

3. BELGIQUE HORTICOLE 6: 231, 232. 1856.

In a section entitled "Plantes nouvelles de serre froide et tempérée." and subtitled, "Mises pour la première fois dans le commerce, par M. J. Linden" five species are listed: *Calypttraria haemantha*, *Cuphea eminens*, *Monochaetum ensiferum*, *Gonocalyx pulcher*, and *Scutellaria trianaei*. Preceding the descriptions is a notation "Extrait du catalogue de M. Linden,

pour 1856.” The text is nearly a faithful reproduction of the *Catalogue* presentation. There are no illustrations.

4. REVUE HORTICOLE IV, 5: 162–165. 1856.

In an article by Ch. Martins entitled “Revue de l’Horticulture étrangère” is a description of *Gonocalyx pulcher* which was taken from the *Gardeners’ Chronicle*. The description is a French translation of the English translation.

It would appear that no one seriously considered the possibility of valid publication of *Gonocalyx* in Linden’s *Catalogue* of 1855. It is absolutely clear that Linden supplied the text and illustration to *Gardeners’ Chronicle* with the intent of publicizing his new plant. The *Floricultural Cabinet* of the same month indicates that the plants are available through Mr. Linden’s London agent. We suspect that there was a bit of promotion on Mr. Linden’s part and that the source of information and of the illustration in the *Cabinet* was the *Gardeners’ Chronicle*. The two remaining publications of 1856 are clearly repetitions or translations of previous publications. Corroborative evidence indicating that this interpretation is correct is to be found in the nature of the illustrations. The *Catalogue* contains a fine colored plate which includes three flowering branches and several vegetative ones. The plate in the *Chronicle* is the left-hand flowering branchlet from the *Catalogue* printed without color and in reverse. The illustration in the *Cabinet* is the central flowering branchlet from the *Catalogue*. The complete (and original) plate which appears in the *Catalogue* was, in my opinion, originally prepared for publication in the Belgian periodical *Flore des Serres*, but never used there. All facts lead to the conclusion that Linden’s *Catalogue* of 1855 did precede all the 1856 publications and should be considered the place of valid publication for *Gonocalyx pulcher*. I believe the description (*Catalogue* (Prix-courant de l’établissement d’introduction pour les plantes nouvelles) p. 5, 6. 1855) should be interpreted as a combined generic-specific description and that priority of *Gonocalyx* was established at that time. Indirect evidence (i.e., the title page lists “Printemps, Été et Automne de 1855”) may point to publication late in the year.

A parallel problem with that of publication is that of typification. A. C. Smith typified *Gonocalyx pulcher*, the type species, by a specimen grown and deposited at Kew (specimen collected in October 1879). This sheet bears the *Gardeners’ Chronicle* reference and it is possible, if not probable, that the specimen had its origin from Linden’s original sale offering. The important questions are when, where, and by whom the original gathering was made. On the basis of the information supplied by Linden, the original discovery was made by Schlim (Linden’s half-brother) “en compagnie du *Calyptratia haemantha*, etc., dans les provinces de Pamplona et d’Ocaña.” According to Linden, *Calyptraria* was discovered in 1844 by Schlim at the Paramo de Cachiri and was later found also at Ocaña.

It is of interest that other sources² place Schlim with Linden from the beginning of 1844 (exploring the Santa Marta) until 4 March when they sailed for Europe. Coincidentally, Planchon sets the date of discovery of *C. haemantha* as 1847 (Flore des Serres 9: 171, 172, *pl.* 924. 1854). In October of 1845 Funck and Schlim returned to South America and began exploration and plant collection on behalf of Linden. They collected around Pamplona, Chinácota (and Ocaña?) until Funck departed in 1847 with the plant shipment for Europe. Perhaps it is to this date of introduction for *Calypttraria* and not to the date of actual discovery to which Planchon refers. Linden stated that Schlim collected seeds and plants of the *Calypttraria* from the Ocaña site and that these were the origin of the plants which he offered for sale. It is possible that it was at this time that the *Gonocalyx* specimens were collected. However, Schlim remained in Colombia following Funck's departure and continued to collect in the vicinity of Pamplona (all specimens lost by shipwreck) and then near Ocaña. He returned to Europe in August of 1852. I believe it is clear that the *Gonocalyx* was not collected in 1844 but sometime between 1845 and 1852. If, indeed, Schlim was the sole collector the date is narrowed to the 1847-52 period.

Perhaps a more significant point is the role played by Planchon in this instance. Planchon collaborated with Linden and it was he who did the technical botanical aspects of their joint efforts. Planchon was at Ghent from 1849 to 1851, at Nancy from 1851 to 1853, and arrived in Montpellier in 1853. Linden would have sought Planchon's critical opinion prior to any decision to publish, particularly with such an interesting plant in a difficult family. A specimen, deposited at Montpellier, of *Gonocalyx pulcher* bears the printed label of J. Linden for the "Voyage de L. Schlim." The geographic data (Ocaña) correspond to expectations. The date is given as 1851 and the collection number is 153; further, the notation "(vivant)" is included on the label. In addition, there are critical notes on the flower morphology. It is apparent that the *Schlim* 153 (MPU) is the holotype (photo A) of *G. pulcher* Planchon & Linden and that Smith's typification was in error.

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² E. P. KILLIP. Report of the Killip-Smith botanical expedition to Colombia, 1926-1927. Jour. N. Y. Bot. Gard. 28: 205-220, see especially footnote 3. 1927.